



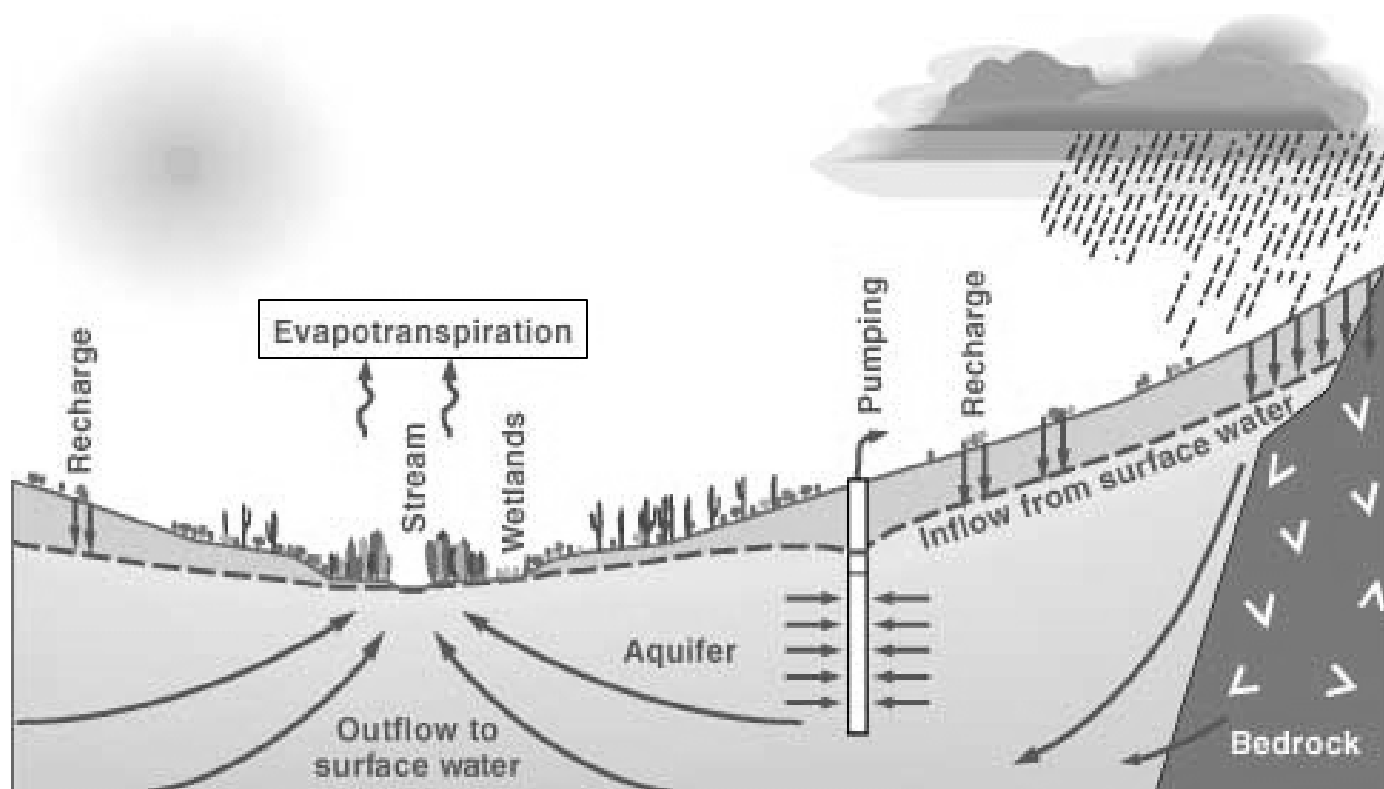
Evapotranspiration

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Evapotranspiration (ET)

- ET is water that is evaporated from surfaces and transpired by plants as a part of their metabolic processes.
- It can result in a significant loss of water.

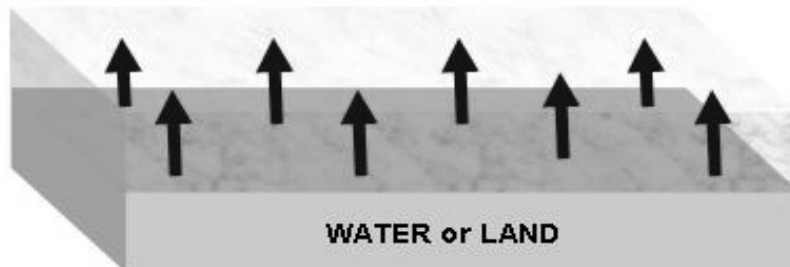


*The role of
ET in the
water
cycle.*

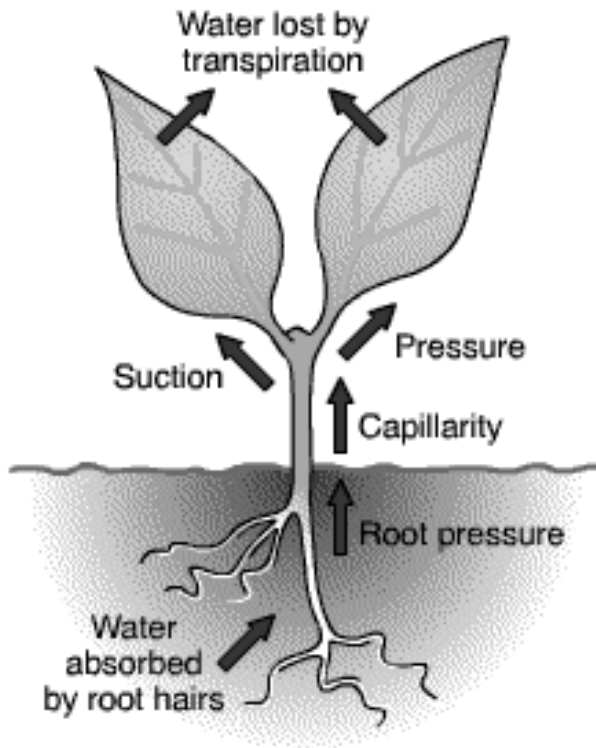
Evaporation

- **Evaporation is the process whereby liquid is converted to vapor (vaporization) and removed from the evaporating surface (vapor removal).**
- **Water evaporates from a variety of surfaces, such as lakes, rivers, pavements, soils and wet vegetation.**

**EVAPORATION CONTINUOUSLY MOVES
WATER FROM THE SURFACE TO THE ATMOSPHERE**



Transpiration

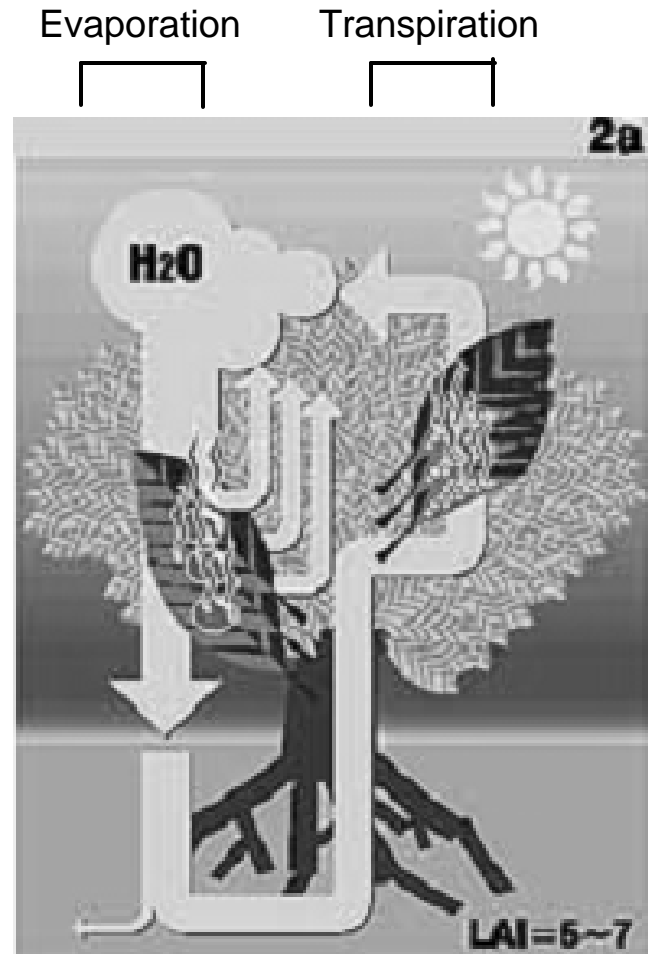


Transpiration consists of the vaporization of liquid water contained in plant tissues and subsequent vapor removal to the atmosphere.

Crops predominately lose their water through the stomata, which are similar to human sweat glands. Transpiration cools plants and enables mass flow of minerals to where they are needed in the plant.

ET Process

- **Evaporation and transpiration occur simultaneously.**
- **There is no easy way of distinguishing between the two processes.**
- **Apart from the water availability in the topsoil, evaporation from a cropped soil is mainly determined by the fraction of the solar radiation reaching the soil surface.**



Changes Over a Plant's Life

- This fraction of solar radiation decreases over the growing period. As the crop develops, the crop canopy shades more and more of the ground area which reduces the amount of evaporation taking place.



- When the crop is small, water is predominately lost by soil evaporation. However, once the crop is well-developed and completely covers the soil, transpiration becomes the main process.

Managing the Effects of ET

- **ET is one of the most important things to consider when scheduling run times for irrigation systems.**
- **Considering the effects of ET and adjusting accordingly will result in saving money and water.**



Societal Role

- It is important to determine how our water should be used. Various options include swimming pools, golf courses, reservoirs, and agriculture.
- Science and technology play a crucial role in supporting these choices with rational decision-making.



Alternative: Hydroponic Forage



- **Growing forage hydroponically can drastically reduce the amount of water needed for feeding livestock.**
- **With hydroponics, forage is grown using highly efficient and conservative watering systems.**
- **Because the ET is eliminated using a cover, the amount of water use by fifty times less than conventional field production.**

Why CEA? ... Huge Potential for High Water Efficiency and Land Productivity

Comparative annual water use (typical)

open field tomato production
greenhouse tomato production
open field forage production
greenhouse forage production

11.3 acre-feet/ton
2.0 acre-feet / ton
0.8 acre-feet / ton (dry wt.)
0.016 acre-feet / ton (dry wt.)

**x 6 – 50
reduction in
water use**

Comparative annual land area productivity (typical)

open field tomato production
greenhouse tomato production
open field forage production
greenhouse forage production

10-50 tons/acre
300 tons/acre
5 tons/acre (dry wt.)
2000 tons/acre (dry wt.)

**x 6 – 400 area
productivity
increase**

Comparative annual wholesale value (typical)

cash field grains
field produced fruits / vegetables
greenhouse agriculture / vegetables

\$300-\$500/acre
\$3000-\$5000/acre
\$300,000-\$500,000/acre

**x 100 - 1000
increase in
production
value**